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STUDIES IN PROBLEMATIC ORGANISMS.

No. II.—The Genus FUCOIDES.*

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The literature dealing with "problematic organisms" is very extensive. From the year 1822, when the genus FUCOIDES was established, up to the present time, the number of species described is enormous. No complete bibliography on the subject has ever yet appeared, the only one of any extent being that of Nathorst, published in 1881.† This list gives 130 titles, but it is by no means complete, and many papers have appeared since it was printed. It is not the intention to give in this place a review of this vast mass of literature, instructive though it might be, but to take up the first genus to be proposed in any formal and scientific manner, and to give a history of it.

The genus FUCOIDES was first proposed and defined by Adolphe Brongniart in 1822.‡ In a table of the classes and genera of fossil plants we find the following description:

"Frond unsymmetrical, often disposed in an even plane, with nerves none or badly limited. (Pl. III, Fig. 3.)" In the course of the article the genus is mentioned several times. The following remarks occur on page 237:

"None of the authors who have written on fossil plants, I believe, speak of fossil Fuci, to which we give the name of

*(NOTE).—No. 1, "The Genus Scolithus," was published in Bull. Geol. Soc. Am., vol. iii, 1891, pp. 32-44.

†Om spår af några evertebrerade djur m. m. och deras palæontologiska betydelse; accompanied by an abridged translation in French, "Memoire sur quelques traces d'animaux sans vertebres, etc., et de leur portée paléontologique. Kongliga Svenska vetenskaps-Akademiens Handlingar for 1880 (No. 7).

‡Sur la classification et la distribution des végétaux fossiles en général, et sur ceux des terrains de sédiment supérieur en particulier. Mem. Mus. d'Hist. Nat., vol. viii, Paris, 1822, p. 210.

FUCOIDES.* There is not, nevertheless, the least doubt of the analogy of the greater number of these plants with those of the family of Algæ; this analogy is so evident that we have determined to unite in one genus all the fossils that appear to have belonged to the family of non-articulate Algæ, though the variable forms presented by the plants of this order render the characters of the fossil genus difficult to establish. The whole of these characters give, however, to these vegetables a sufficiently distinct aspect to prevent them being confounded with any other fossil plant."

The next reference is as follows:

"FUCOIDES:—I do not enter here into details of the species of *Fucoides* of the upper sedimentary terrane, since I will do this in a special work, wherein will be given the *Fucoides* of various terranes; a work in which M. Agardh has kindly offered to aid me with his council, and to which the profound knowledge this celebrated botanist has of the plants of the family can give a very great degree of exactness.

"I shall here content myself with saying that the small number of species so far observed in the upper sedimentary terrane appear to agree sufficiently with established genera of the family, and that some species very closely resemble even living species.

"It is principally at Monte Bolca, near Verona, that these fossils have so far been discovered." (pp. 307–308.)

The last reference to the genus in the paper describes the localities where the fossils had been found,† but as this is discussed more fully in the next paper to which we shall refer, the matter will not be entered into here.

The joint paper alluded to, by Brongniart and Agardh, does not seem to have ever been published, but the subject was taken up again by Brongniart the following year. As this second paper is of considerable importance, and is not readily accessible to many, we shall give the preliminary remarks in full, with a mention of the species described. The description of the type species will also be given.

"* Fucoides strictus, Agardh, ined., pl. III, fig. 3. This fossil has been found in beds of lignite, discovered in the island of Aix near Rochelle, by M. Fleurian de Bellevue. It forms part of a work that M. Agardh has kindly undertaken with me on the fossil plants of the family of Algæ."

†Ibid., pp. 335–336.

OBSERVATIONS ON FUCOIDES AND ON SOME OTHER FOSSIL MARINE PLANTS. — By Ad. Brongniart. Read January 31, 1823.*

FUCOIDES.

It is only within a short time that naturalists have commenced to give attention to fossil plants of the family Algæ that are met with in different terranes; of the few, I do not know one old work in which they are mentioned in an exact manner. It seems, however, that these fossils, very common in many parts of Italy, as will be shown later on in this memoir, have attracted the attention of some Italian botanists, and particularly the celebrated Micheli and Jean Targioni.

Brocchi is said† to have found among the manuscripts of the latter, a very excellent work on the Fuci that he found in some calcareous rocks named in Tuscany, *Galestro* or *Querceto*, about seven miles from Florence; but this work, accompanied by 44 plates, unfortunately remains in manuscript, and is, in consequence, unknown to nearly all naturalists. It appears, however, from what Brocchi has said, that the Fuci brought together by him include some species described by us in this memoir; we imagine, however, from the number of plates accompanying the work, that Targioni had many more species than we have knowledge of.

Turner, in his superb work on the Fuci, vol. 2, p. 75, in the article on *Fucus ligulatus*, says that Dr. Scott had told him of the discovery of impressions of this species of Fucus in the basalt of the Chaussee-des-Geauts; but the information is too vague for one to place great confidence in the observation, because there have not been discovered, up to the present, any organized fossil bodies, and especially vegetable, in the basalt.

Finally, last year, M. Schlotheim, in a supplement to his work on petrefactions,‡ has made known, under the name of *Algacites*, some fossils that approach the Algæ or marine plants, and of which he had not spoken in his previous work. At the same time the supplement appeared in Germany, I

*Mem. de la Soc. Hist. Nat. de Paris, vol. 1, 1823, pp. 301–321. pl. 3.

†Bibliotheca Italiana, vol. x, p. 206.

‡Nachträge zur petrefactenkunde, von E. F. Baron von Schlotheim, Gotha, 1822.

pointed out in a paper published in the Memoirs of the Museum* this group of fossil vegetables under the name of *Fucoides*, and I announced then the work that I publish now.

The examination that M. Agardh gave to these fossils at the time of his stay in Paris, (in January, 1821,) and the observations that he has been good enough to communicate on the subject, certainly add greatly to this notice. Thus, I have carefully indicated by the words *Ag. Mss.* the species I have been able to submit to this able botanist, who has made a special study of the family of Algæ. These species have been mentioned by him in the *Species Algarum*, of which he has published the first volume; but during this period the number of species that I know has been greatly increased, and it is possible, that when careful search has been made in the places where some have already been found, a much larger number may be distinguished.

I have not spoken in this memoir of the so-called Confervæ found in crystals of quartz, not having had occasion to examine them myself; I can do no more than report what authors have said, and I prefer in this case to refer to a memoir published on this subject by M. J. MacCulloch in the Geological Transactions,† where very good figures will be found. I would remark, however, that if these singular branchings are really the remains of vegetable organisms, they should form a special genus among fossil plants; one in which we shall be able to place all the fossil confervoid vegetables having articulated filaments.

In addition to the species observed by myself, I am indebted for five figures to M. Schlotheim, given under the names of *Algacites crispiformis*, *filicoides*, *granulatus*, *orobiformis* and *frumentarius*, in the work already cited; but among these fossils only the first species I believe may be placed among the plants evidently belonging to the family of Algæ; the others appear to me to differ so widely from the living Fuci, that I have grouped them at the end with some other doubtful species that I have not cared to place positively in this family. It is easy to see how difficult it is to fix accurately

*Sur la classifi. et la distri. des Veget. fossiles. Mem. du Mus., vol. viii.

†On vegetable remains preserved in Chalcedony, by J. MacCulloch, M. D. Trans of the Geol. Soc., vol. ii, Lond., 1814. p. 510.

the limits of a family when the living genera and species present so many variations in their forms and aspects, even when one is familiar with the more important characters establishing the exact similarity, such as the internal organization and the mode of fructification, characters that we can never observe in the fossils. In these, one is confined to external characters, that show the appearance, the form and the general aspect of the plant after it has passed into a fossil state. We believe, however, that all the world is in accord with us in placing in the family of non-articulate Algæ the species that we have placed with certainty in this family. Among those we have put with doubt at the end of the genus *Fucoides*, there are only two that I have seen for myself, and their form is so singular that we have not placed them with certainty among the marine plants; we do not know the four others, except from the figures of M. Schlotheim, and we have already said of these figures that they differ so widely from all the Algæ described and figured by botanists, that we doubt much their forming part of this family.

While there seems to us little doubt as to the position the fossils that we describe in this memoir should occupy in the vegetable kingdom, it is not the same with the distinction of species; in reality, nothing can be more embarrassing than to tell which of these fossil bodies, generally very variable in the same species, should be considered as species and which as varieties. It becomes much more difficult when one must often decide for himself from few specimens; we believe, therefore, that when a great number has been observed, we may, perhaps, be obliged to unite many species in one. But for the present it has appeared more convenient to separate all that offer such distinct characters as to lead to the presumption that the fossils belong to different species.

In regard to the horizon of these vegetable fossils, it should be remarked that all those known at present belong to four different formations: 1. The *Fucoides* of Monte-Bolca, near Verona. I shall say nothing of this celebrated locality, my father having described it with details in the memoir he has published on the calcareous traps of Vicentin. I repeat only his statement, that this terrane is a sedimentary formation above the Tertiary, and I would remark that the fossil plants

are found not only in the same beds, but frequently on the same slabs, as the fish; so that all that has been said of the one applies as a consequence equally to the other.

The species that belong to this locality apparently come closest to, more so than any others, actually living species, and in general to those that grow in the temperate oceans. It is only necessary to except the two species we have placed with doubt in the genus *Fucoides*, under the names of *Fucoides discophorus* and *turbinatus* and *Fucoides agardhianus*, which, especially, approaches *Caulerpa*, and, in consequence, to a genus belonging almost entirely to the equatorial or southern oceans.

2. The fossil Fuci discovered in the lignite of the island of Aix, near Rochelle, by M. Fleurian de Bellevue, and for the knowledge of which I am indebted to that *savant* and to M. d'Orbigny. The lignite in which they are found has been indicated by my father as a type of the lower marine lignite of the chalk.* It does not contain any other determinable vegetables, except the leaves we describe in this memoir under the name of *Zosterites*. They appear to be composed almost entirely of these Fuci and of the stems of trees, among which I have not seen up to the present those of Dicotylodons. Besides the two species of *Fucoides* we describe in this memoir, there were included the debris of a great many species, too incomplete to be determined.

3. The species of *Fucoides* found in the limestones of Stonesfield, near Oxford, and of which M. Buckland has willingly given me a very correct plan. The beds here included belong, according to this celebrated geologist, to the calcareous oolite of the Jura. These beds contain, besides the *Fucoides*, plants that we have placed with *Lycopodites*,† and portions of leaves very probably belonging to ferns. These specimens of ferns, that I did not know of on the publication of my first work on fossil vegetables, occasion some modification of the information I have given of the fossil vegetables of the Jurassic limestone in which I had not then found the ferns, and proved that these vegetables are found again in the lower formations of the Coal terrane. The only

*See the article "Lignite," in the *Dictionnaire des Sciences Naturelles*.
†*Lycopodites bucklandi*. Mem. du Mus., vol. viii.

two species of *Fucoides* that I know of from this terrane, appear to belong to an almost entirely exotic genus, to the genus *Caulerpa* of Lamouroux, that does not exist in our seas, except one species, very different from the fossil species.

4. *Fucoides furcatus*, *recurvus*, *difformis*, *æqualis* and *intricatus* are found in a formation that is represented in many very remote places with nearly similar characters, but the position of which is not yet well fixed by geologists, and which my father presumed might belong, like those of the Island of Aix, to the lower lignites of the chalk.

Thus, *Fucoides intricatus* is found near the chateau of Malaspina, near Sarzana; in the marls accompanying the lignites quarried near Kaltenberg, to the north-east of Vienna, in Austria; and the hill west of Genoa, between St. Stephan and St. Morizzio, near Oneille, without one being able to establish the least difference between the Fucus forms themselves, or in the rocks in which they are enclosed.

Fucoides æqualis is found at Vernasque, in the Appenines; to the south of Fiorenzola, in the Plaisantin; and at Bidache, near Bayonne, in exactly similar marls.

Fucoides furcatus is represented at Vernasque; in the environs of Vienna, and near Sarzana.

Finally, *Fucoides recurvus* has been found thus far only at Vernasque, and *Fucoides difformis* only at Bidache.

But the perfect resemblance of the two other species, and those of the rocks in which they are contained, seems to have sufficiently established the analogy of these terranes. It is curious to note that these various species seemingly belong to one and the same section of this genus, and this renders it more difficult to well define their limits.

Having indicated the geological position in which these fossils are found, I shall now proceed to describe the species that I can refer to the genus *Fucoides*.

Fucoides.

Frond continuous, often membranaceous and spreading in the same plane; the two sides generally unequal; nerves more or less ill-defined, never regularly divided or anastamosing.

Obs.—The absence of characters deduced from the fructification or of the internal structure in these fossils, renders the characters of this group very vague; however, the absence of all vascular nerves and the continuity of the frond, are two essential characters of the Algæ that one finds in all the fossil species that we here describe; some of these present, it is true, a middle nerve, but this nerve is large, thick, badly defined, and never sends out regular secondary divisions.

It is quite evident from his remarks that, while Brongniart recognized the boundaries of the genus as vague and the limitations of the species difficult to state, he had no hesitation in placing it with the Algæ; and in many of his species he was correct, as later investigations have shown. The difficulty of the whole matter lies in the fact that authors, delighted to have some place in which to place the innumerable forms they felt sure were not of animal origin, referred them all to the vegetable kingdom and called them fucoids. Hence, we find under the genus FUCOIDES an *omnium gatherum*, which it has required the labors of many years to sift. This one genus has contained in its time upward of 100 species and varieties. Virtually, it now contains none, although, as we shall show later on, we believe at least one should be placed there. The species described by Brongniart, in 1823, are as follows:

Fucoides orbignianus	Fucoides gazolanus.
strictus.*	lamourouxii.
crispiformis.	agardhianus.
furcatus.	pennatula.
recurvus.	elegans.
difformis.	discophorus.
æqualis.	turbinatus.
var. flexilis.	Algacites frumentarius, Schlotheim.
intricatus.	orobiformis, "
obtusus.	filicoides, "
flabellaris.	granulatus, "

One of the laws of nomenclature requires that the first species of a genus proposed be taken as the type of that

*Although placed second here, this was the form mentioned in 1822 as the type of the genus.

genus. There can not be the least doubt in the present case that *strictus* was the first species described under the new generic name. This being the case, it is well to give the description of the species. It is as follows:

"FUCOIDES STRICTUS. — Frond linear, bifurcating, with the branches erect, fastigiate and close together; midrib broad, flattened, tuberculate and prominent, with undulate margins. (Pl. xix, Fig. 2.)

"*Sphærococcus? strictus* Ag. MSS.

"*Rhodomela? diluviana* Ag. Spec. Alg. I, p. 383.

"*Fucoides strictus* Ad. Br., Class. veg. foss., p. 37, tab. 3, fig. 3.

"Locality.—In the lignite of the Isle of Aix, near La Rochelle. (Fleurian de Bellevue, d'Orbigny.)

"This species resembles greatly in its general form *Fucus obtusatus* Labill., N. Holl., but it differs in the large and flat nerve that traverses the frond, and that fails entirely in *Fucus obtusatus*. The fossil species has a more rigid and fastigiate aspect. The arrangement of the nerve shows some analogy to *Fucus alatus*, but it differs greatly by its size and more erect and scattered branches. The generic position in the Algæ is very difficult to assign. It is probable that the tubercles observed on the middle nerve are the organs of fructification."

Further remarks upon this and other species of the genus will be deferred until later on in this paper.

In 1825 appeared volume one of a memoir by Sternberg, under the title of "Versuch einer geognostisch-botanischen darstellung der flora der vorwelt." In this numerous species of *Fucoides* are given, most of them from Brongniart. We find the genus broken up and the species referred to various sub-genera. These are taken from living genera which seem to bear the closest resemblance to the fossil forms. Among them are *Chondria*, *Sargassum*, *Caulerpa*, *Delesseria*, etc. A single new species seems to be described, viz: *Fucoides cylindricus*, while *F. granulatus* is used to replace *Algacites granulatus* Schloth.

The next publication bearing upon the subject was an important one. It was Brongniart's "Histoiré des végétaux fossiles, ou recherches botaniques et géologiques sur les

végétaux refermes dans les diverses couches du globe." The first volume, bearing date of 1828, treats of cryptogams, Algæ among them. In his introductory remarks the author says: "We give this name [Algæ] to all the aquatic cryptogams without articulations that form the two families *Ulvaceæ* and *Fucaceæ*, families that we have found in many cases difficult to distinguish in a fossil state, their characters being essentially in the arrangement of the reproductive bodies, and in the character of the tissue that composes their fronds, both characters that disappear very soon in fossil plants." He then proceeds to examine the characters of living Algæ, noting the distribution of various genera and their characters, but, before taking up the genus *Fucoides* and the species referred to it, he says: "We have not divided this family into distinct genera, mainly because the proper characters to exactly define them are very rarely apparent, and the classification can not be a precise one; but we have divided the general group of fossil Algæ, to which we have given the name of *Fucoides*, into sections founded on the form of the frond, sections that correspond quite exactly with one or more genera of living Algæ."

It is quite evident that Brongniart, while recognizing the diverse characters of the plants, also saw the difficulties in the way of arranging them in a satisfactory manner. The great diversity becomes very evident when the species described are studied in detail. The following is a list of the species in the sections given by the author. The new species are indicated by "n. sp.:"

I. Sargassites.

1. F. septentrionalis, (Ag.) sp.

2. F. sternbergii, n. sp.—*Algacites caulescens* Stern., and *F. bohemicus* Stern.

II. Fucites.

3. F. strictus, Br.

III. Laminarites.

4. F. tuberculosus, n. sp.

IV. Encoelites.

5. F. encoelioides, n. sp.

V. Gigartinites.

6. F. targionii, n. sp.
7. F. difformis, Br.
8. F. æqualis, Br.
9. F. intricatus, Br.
10. F. obtusus, Br.
11. F. stockii, n. sp.
12. F. recurvus, Br.
13. F. furcatus, Br.
14. F. antiquus, n. sp.

VI. Delesserites.

15. F. lamourouxii, Br.
16. F. spathulatus, n. sp.
17. F. bertrandi, n. sp.
18. F. gazolanus, Br.

VII. Dictyotites.*

19. F. flabellaris, Br.
20. F. multifidus, n. sp.
21. F. digitatus, n. sp.

VIII. Amansites.

22. F. dentatus, n. sp.
23. F. serra, n. sp.

IX. Caulerpites.

24. F. lycopodioides, n. sp.
25. F. selaginioides, n. sp.
25.*bis* F. hypnoides, n. sp.
26. F. frumentarius (Schloth.), sp.

*In the Proceedings of the U. S. National Museum (Vol. xvi, 1893, p. 113), Dr. D. P. Penhallow has applied this name to a *new genus* of fossil plants. On page 109 he mentions its use by Brongniart in 1828, but, considering that the name "has lost its function," he uses it again. Such a proceeding is not in accordance with the generally adopted rule of nomenclature, that a name once used can not be used again, if applied to a new organism. We do not believe Dr. Penhallow's action will be generally concurred in.

27. F. nilsonianus, n. sp.—*Caulerpa septentrionalis* Ag., and *F. imbricatus* Stern.

28. F. brardii, n. sp.—*Carpolithes hemlocinus* (?) Schloth.

29. F. orbignianus, Br.

X. Species that do not appear to belong to any of the preceding.

30. F. agardhianus, Br.

*Doubtful species.

31. F. pectinatus, n. sp.—*Carpolithes* (?) and *Algacites orobiformis* Schloth.

32. F. turbinatus, Br.

33. F. discophorus, Br.

34. F. lyngbianus, n. sp.

35. F. (?) cylindricus, Stern.

36. F. circinatus, n. sp.

It will be observed from this list that the type of the genus, *F. strictus*, is placed under the second section, FUCITES, by itself. In putting it here Brongniart says that it resembles in its general form *Fucus obtusatus*, but differs essentially in a large and thick nerve that traverses the frond; furthermore, that it is really more like a solid axis than a real nerve. There are various other differences. A comparison is also made with a species of *Rhodomela*, but it is finally stated that the fossil differs from all living species known to the author. (p. 53.)

This fossil is, in all probability, the remains of a plant;* and in view of this fact, and because the genus contains species that have been referred to various genera, it seems best to return to the original name, restrict the genus to the one species and call it FUCOIDES STRICTUS Brongniart. (Pl. III, Fig. 2.)

Of the remainder of the species, there are but six which call for any special attention here. They are:

F. targonii.
F. difformis.
F. recurvus.
F. furcatus.
F. antiquus.
F. circinatus.

*This plant seems to be the same as Goeppert's species *Haliserites dechenianus*. Certainly the figures correspond almost exactly, and specimens of Goeppert's species would very readily pass for Brongniart's *Fucoides strictus*. It seems, therefore, best to the author to reduce Goeppert's name to a synonym of *F. strictus*. Should this be done, it will necessitate a change in certain new varieties and species made by Penhallow in the paper cited above.

Of these six, five were placed by Brongniart in his subgenus GIGARTINITES. They have been generally referred to the genus *Chondrites*, of Sternberg. There is every reason for believing that this genus, like *Fucoides*, contains a number of diverse forms, and will have to be finally broken up. Undoubtedly a great number of the species are remains of plants, but those in the list above given are doubtless worm burrows. They are, at all events, very problematic organisms, and we propose that the genus *Gigartinites*, Brongniart's section, be established for the first five species. The species *targionii*, as the first one described by Brongniart under his section, should be taken as the type. They would then stand as follows:

Gigartinites targionii, (Br.) Gigartinites furcatus, (Br.)
difformis, (Br.) antiquus, (Br.)
recurvus, (Br.)

The figures which are given illustrate these species. They are taken from Brongniart's Histoire des Végétaux Fossiles, Vol. 1. (Pl. III, Fig. 1; Pl. IV, Pl. V.)

The last species of the list is *F. circinatus*, and of this we also give a figure (Pl. III, Fig. 3). It differs in many ways from the others, and of it Brongniart says: "This *Fucus* attained nearly a foot in height; it is in general enclosed in the freestone perpendicularly to and not parallel with the beds, like the most of the plants transported and deposited in the place where the rock enclosing them was formed." (p. 84.) From this statement it seems evident that the fossil was not a plant, and in all probability it represents the remains of a worm burrow. It presents a great analogy to several species described by Billings as *Licrophycus*. It will be referred to at another time in more detail.

In 1831 Germar and Kaulfuss* described and illustrated *Fucoides acutus*. This is, in all probability, a plant, and is now known under the name of *Aphlebia acuta* (G. & K.,) Presl. In the same year (1831) Richard Harlan described† and illustrated *Fucoides alleghaniensis* as a new species occurring in one of the ridges of the Alleghany Mountains. This species is now generally known as *Arthrophycus harlani*, but its

*Acta Acad. Cæs.-Leop. Carol. Nat. Cur., vol. xv, pt. 2, p. 230.
†Jour. Acad. Nat. Sci. Phil., vol. vi, pp. 289-291, pl. 1.

proper designation should be *A. alleghaniensis*.* In January, 1832, the same writer† described a second species under the name of *F. brongniartii* from a sandstone beneath the "coal formation," occurring in the western part of New York. This is the same species as that described by him previously. In 1833, Mantell‡ described *Fucoides brongniartii*, not knowing of the previous use of the name. This is a very different species from that described by Harlan, and seems to be part of the frond of a fern. Its specific designation will probably not have to be changed, as it does not belong to the genus *Fucoides*. In 1835, Aug. von Gutbier‖ described the following species, most of which are of real vegetable origin:

F. filiciformis.	F. crispus.
radians.	crenatus.
filiformis.	dentatus.
linearis.	

Of these *F. crenatus* is a problematical form; *F. dentatus*§ is now *Rhacophyllum flabellatum*. In 1835, Hitchcock¶ described *Fucoides shepardi* as a sea weed which penetrated the rocks perpendicularly. This is now known as *Scolithus shepardi*.** In 1837, Messrs. Lindley and Hutton described and illustrated *Fucoides arenatus*.†† This is doubtless a worm burrow, similar in aspect to *F. antiquus*, and may be the same. In the same year, Hisinger‡‡ described a variety of *F. antiquus* under the name of var. *gracilior*. This is also a problematic organism and scarcely differs from *F. antiquus*.

In 1838 appeared the second volume of Sternberg's work,‖‖ the first volume of which had been printed in 1825. Here we find Brongniart's genus broken up into various genera.

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*This subject has been thoroughly investigated by the author, and the details are given in another paper, not yet published. It was, however, read before the American Association for the Advancement of Science, at Madison, in August, 1893.

†Harlan, R. Monthly Am. Jour. Geol. and Nat. Sci., vol. i, pp. 307-308.

‡Geology of the Southeast of England. London, 1833, pp. 95-96.

‖Abdrucke und versteinerungun des zwickauer Schwarzkohlengebirges und seiner umbebungen. Zwickau, pp. 36, pl. 11.

§Brongniart had used this name in 1828.

¶Rept. on Geol. Min. Bot., and Zool. of Mass., 2d ed., p. 236.

**James, J. F. Bull. Geol. Soc. Am., vol. iii, 1891, p. 32.

††Fossil Flora of Great Britain, vol. iii, p. 93, pl. 185.

‡‡Lethaea svecica. Holmiae, 1837, p. 106. Supple., 1840, p. 2.

‖‖Versuch einer geognostisch-botanischen darstellung der flora der vorwelt. Prag. 1838. Folio.

the most of them being equivalent to his sections. All are arranged under Algæ, and a number of new genera are proposed. For example, we find that *Rhodomelites* is proposed for *Fucoides strictus*. *Chondrites* is proposed for the group *Gigartinites* of Brongniart. *Sphærococcites*, *Halymenites*, *Munsteria*, *Haliserites*, *Zonarites*, *Cystoseirites*, are among the new names. *Fucoides taxiformis* Sternb., 1825, is referred to *Cystoseirites*; and *Fucoides dichotomus* Reich (in litt), is referred to *Haliserites*. The species referred to *Chondrites* are as follows:

C. targionii, Br.
difformis, Br.
æqualis, Br.
intricatus, Br.
recurvus, Br.
furcatus, Br.
C. antiquus, Br.
circinnatus (!), Br.
laxus, Sternb.
obtusus, Br.
turbinatus, Br.
discophorus, Br.

Of these, the 1st, 2d, 5th, 6th and 7th, we have referred above to the genus *Gigartinites*. The others are for the present left in *Chondrites*, although it is not improbable that they will be subsequently referred to other genera. Some of them are of undoubted algal origin. In the same year (1838) Conrad* changed Harlan's *Fucoides alleghaniensis* to *F. harlani*, and at the same time mentioned several other species of *Fucoides*, but without descriptions. Among them was *F. demissus*, which was subsequently described by Hall as *Phytopsis tubulosa*, and is now generally recognized as a coral. In the same report (p. 111) *Fucoides cauda-galli* was named. This species was afterward referred to *Spirophyton* by Hall, but it should probably be placed in the genus *Taonurus*. This question we hope to discuss another time. In 1840, S. S. Haldemann† published a description of a fossil referred by him with a query to the genus *Fucoides*, coining for it, however, in the next paragraph, the new genus *Scolithus*. This is evidently a worm burrow, and ever since its description has been considered the type of *Scolithus*. It need not be further considered.

*2d Ann. Rept. Geol. Sur. N. Y., 1838, p. 113.

†Supplement to No. 1 of "A Monograph of the Limniades or Fresh Water Shells of North America."

In 1842, Vanuxem* figured *Fucoides biloba* from the Clinton. This is now called *Cruziana bilobata*. In the same volume he described the "Cock-tail" Grit as characterized by several peculiar forms of "fucoids," calling them "curtain" and "retort" fucoids. These species are now placed in the genus *Spirophyton* or *Taonurus*. *Fucoides graphica*, a very problematic organism, is also described. Of it Vanuxem says, that "as yet the real nature of these bodies is doubtful, and they are, therefore, classed as fucoids." (p. 173.)

Several species of the genus were described by Hall in 1843.† Of these *F. auriformis* (p. 471, and *F. heterophyllus* (p. 471, from the Medina, are of inorganic origin, and should be expunged from lists of fossils. *Fucoides gracilis*, later on referred to the genus *Buthotrephis*, was described on page 69. It is probably referable to *Chondrites*. *Fucoides verticalis* (p. 242) is a worm burrow, and is now referred to the genus *Scolithus*. In 1844, Emmons‡ described as new *Fucoides flexuosa* and *F. rigida*. Both of these are worm burrows, probably forms of the same. He also figured on plate five *F. simplex*, which is now recognized as a graptolite. The following year (1845) Pomel‖ described two species under the names of *Fucoides beaumontianus* and *dufrenoyi*, both of which are, as far as descriptions indicate, of vegetable origin. I do not know in what genus they are now placed. In 1847, Prof. James Hall§ referred *F. rigida* and *F. flexuosa* to a new genus with a query, under the name of *Buthotrephis flexuosa*, considering the former species a synonym (p. 263)¶: while in the following year (1848) McCoy** referred both the above species of Emmons and *F. antiquus* Brong., from Norway, to *Chondrites*. In 1851, Prof. James Hall†† figured and mentioned *Fucoides duplex* from the Potsdam. As there is no description, it is necessary to study the figure, and this would indicate an approach to some species of *Cruziana*. It may be this species that is called by Chamberlin‡‡ *Palæophycus duplex*. In

*Geol. Sur. of New York, Rept. of the 3d Geol. Dist., 1842, p. 79.
†Geol. Sur. of New York, Rept. of the 4th Geol. Dist., 1843.
‡The Taconic System, 1844.
‖Bull. Geol. Soc. France, 2d ser., t. ii, 1845, pp. 310–311.
§Pal. of New York, vol. i, 1847.
¶Quart. Jour. Geol Soc. London, vol. iv, 1848, p. 224.
**Foster and Whitney Lake Superior Land District Rept., part 2, p. 226, pl. 23A.
††Geol. of Wisconsin, vol. i, 1883, p. 126.

1852, Goeppert* described, under the name of *Haliserites deschenianus*, a fossil which presents every appearance of being the same as Brongniart's *Fucoides strictus*.† In 1874, Schimper‡ placed *Fucoides antiquus* as the type of the genus, but it is difficult to understand how this can be so when this species was not described until 1828, long after many other forms had been described. This same reference is made by Roemer in 1880.‖

In 1865, Oswald Heer§ mentioned the occurrence of three species of *Fucoides* under the names of *rigidus*, *procerus* and *moeschii*. The last is the only one figured, and it is a very problematical form, having something the shape of Billings's genus *Arthraria*. It certainly is not congeneric with *Fucoides strictus*. Finally, the last species we have found referred to the genus is *Fucoides rouaulti* Lebsc. This was described in 1883,¶ but mentioned again in 1886.**

In the preceding pages it has been the endeavor of the author to present an accurate statement of the genus *Fucoides*, and to give accurate bibliographic items regarding the species referred to the genus at various times. Many points have been left untouched which might have been elaborated; and it is hoped that the few suggestions made may be acceptable to the readers of the paper. In the course of the preparation of this and the paper upon *Scolithus*, a large amount of material has been collected. It is the hope of the author to present some of this to the public upon some future occasion. He would feel greatly obliged if his readers would call his attention to errors in the list of species given below.

The following list gives the names of species that have been described as *Fucoides*, with the authority and date and the name which is recognized at the present time. It is very probable that further study will materially change many of the latter names. Some have been referred to many genera

*Novo. Acto. Acad. Caesar. Leopol.—Carol., vol. xxii, supple., p. 185.
†See note on a previous page.
‡Traite de Palæontologie Vegetale, vol. i, p. 442.
‖Lethæa Palæozoica. Text. Erste Lief., vol. i, p. 132.
§Die Urwelt der Schweiz, pp. 70, 100.
¶Œuvres posthemes de Rouault, 1883.
**Bull. Geol. Soc. France, 3d ser., t. 14, 1886, p. 794.

and have experienced many changes. It will only be possible to state accurately the proper name after an investigation of the genera. If the principle of nomenclature, which makes it necessary to use the first specific name be followed, there will be many changes in this respect The list, therefore, as far as the second column goes, is provisional merely. It is believed that the first column is very nearly complete. As already stated, we have restricted the name *Fucoides* to the single species *strictus* Br., 1822. The genus *Gigartinites* is here used as a generic term for the first time, Brongniart using it only in a sub-generic sense:

Fucoides acutus, Germ. et Kaulf., 1831.	Aphlebia acuta.
æqualis, Br., 1823.	Chondrites æqualis.
agardhianus, Br., 1823.	Delesserites agardhianus.
alleghaniensis, Harlan, 1831.	Arthrophycus alleghaniensis.
antiquus, Br., 1828.	Gigartinites antiquus.
var. gracilior, His., 1837.	antiquus.
arcuatus, Lind., & Hut., 1837.	Sphærococcites arcuatus.
auriformis, Hall, 1843.	Inorganic.
beaumontianus, Pomel, 1845.	?
bertrandi, Br., 1828.	Delesserites bertrandi.
biloba, Vanuxem, 1842.	Cruziana bilobata.
bohemicus, Sternb., 1825.	Sargassites sternbergii.
bollensis, Zilt, 1827.	Chondrites bollensis.
brardii, Br., 1828.	Caulerpites brardi.
var., Br., 1828.	Cupressites ullmanni.
brianteus, Villa.	Zoophycos villæ.
brongniartii, Harlan, 1832.	Arthrophycus alleghaniensis.
brongniartii, Mantell, 1833.	?
cauda-galli, Conrad, 1838.	Taonurus cauda-galli.
circinatus, Br., 1828.	Licrophycus circinatus. ?
crenatus, Gutb., 1835.	Aphlebia crenatus.
crispiformis, Br., 1823.	Sphærococcites crispiformis.
crispus, Gutb., 1835.	Aphlebia crispa.
cylindricus, Sternb., 1825.	Halymenites cylindricus.
demissus, Conrad, 1838.	Phytopsis tubulosa.
dentatus, Br., 1828.	Diplograptus pristiniformis.
dentatus, Gutb., 1835.	Rhacophyllum flabellatum.
dichotomus, Reich, in litt. 1838.	Haliserites reichii.
difformis, Br., 1823.	Gigartinites difformis.
digitatus, Br., 1828.	Zonarites digitatus.
discophorus, Br., 1823.	Tympanophora discophora.
dufrenoyi, Pomel, 1845.	?
duplex, Hall, 1851.	Cruziana duplex. ?.

Fucoides elegans, Br., 1823.	Podocarpus sp.
encoelioides, Br., 1828.	Munsteri clavata.
filiciformis, Gutb., 1835.	Rhacophyllum filiciforme.
filiformis, Gutb., 1835.	filiforme.
filiformis, Steing.	?
flabellaris, Br., 1823.	Zonarites flabellaris.
flexuosa, Emmons, 1844.	Chondrites flexuosa.
frumentarius (Sch.), Br., 1828.	Caulerpites frumentarius.
furcatus, Br., 1823.	Gigartinites furcatus.
var. ? Br., 1828.	Halymenites ramulosus.
gazolanus, Br., 1823.	Delesserites gazolanus.
gracilis, Hall, 1843.	Chondrites gracilis.
granulatus (Schl.), Sternb., 1825.	Phymatoderma liasicum.
graphica, Vanuxem, 1842.	?
harlani, Conrad, 1838.	Arthrophycus alleghaniensis.
hechingensis, Quenst.	Chondrites hechingensis.
heterophyllus, Hall, 1843.	Inorganic.
hypnoides, Br., 1828.	Caulerpites hypnoides.
imbricatus (Sternb.), Br., 1828.	Caulerpites nilsonianus.
intricatus, Br., 1823.	Chondrites intricatus.
lamourouxii, Br., 1823.	Delesserites lamourouxii.
linearis, Gutb., 1835.	Aphlebia linearis.
? linearis, Hald., 1840.	Scolithus linearis.
lycopodioides, Br., 1828.	Caulerpites lycopodioides.
lyngbianus, Br., 1828.	Sargassites lyngbianus.
moeschii, Heer, 1865.	?
multifidus, Br., 1828.	Zonarites multifidus.
nilsonianus, Br., 1828.	Caulerpites nilsonianus.
obtusus, Br., 1823.	Chondrites obtusus.
orbignianus, Br., 1823.	Caulerpites orbignianus.
pectinatus, Br., 1828.	Caulerpites pectinatus.
pennatulus, Br., 1823.	Pterophyllum preslanum.
procerus, Heer, 1865.	?
radians, Gutb., 1835.	Rhacophyllum adnascens.
recurvus, Br., 1823.	Gigartinites recurvus.
retortus, Vanuxem, 1842.	Taonurus retortus.
rigidus, Emmons, 1844.	Chondrites flexuosa.
rigidus, Heer, 1865.	?
rouaultii, Lebsc., 1883.	?
selaginoides, Br., 1828.	Caulerpites selaginoides.
serra, Br., 1828.	Graptolithus bryonoides.
secalinus, Eaton, 1832. ? Mss.	Diplograptus secalinus.
septentrionalis, Br., 1828.	Sargassites septentrionalis.
shepardi, Hitch., 1835.	Scolithus shepardi.
simplex, Emmons, 1844.	Diplograptus secalinus.
spathulatus, Br., 1828.	Delesserites spathulatus.

Fucoides sternbergi, Br., 1828.	Sargassites sternbergi.
stockii, Br., 1828.	Halymenites stockii.
strictus, Br., 1822.	Fucoides strictus.
targionii, Br., 1828.	Gigartinites targionii.
taxiformis, Sternb., 1825.	Cystoseirites taxiformis.
tuberculatus, Br., 1828.	Laminarites tuberculosus.
turbinatus, Br., 1823.	Tympanophora turbinata.
velum, Vanuxem, 1842.	Taonurus velum.
verticalis, Hall, 1843.	Scolithus verticalis.

EXPLANATION OF PLATES.

PLATE III.

Fig. 1.— *Gigartinites antiquus* Brong., sp.

Fig. 2.— *Fucoides strictus* Brong; *a*. natural size; *b*. a small portion enlarged, showing dots along each side of a central depression.

Fig. 3.— *Licrophycus? circinatus* Brong., sp.

PLATE IV.

Fig. 1.— *Gigartinites recurvus* Brong., sp.

Fig. 2.— *Gigartinites furcatus* Brong., sp.

PLATE V.

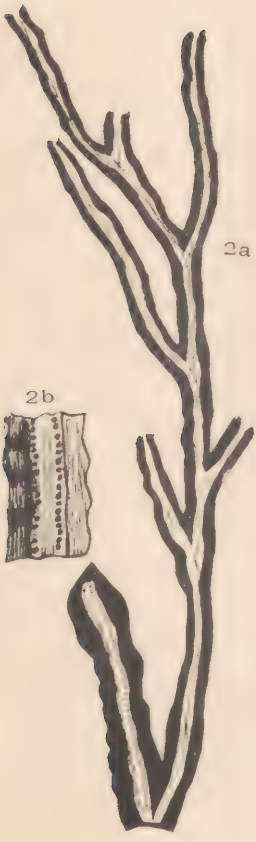
Fig. 1.— *Gigartinites furcatus* Brong., sp.

Fig. 2.— *Gigartinites difformis* Brong., sp.

Fig. 3.— *Gigartinites targionii* Brong., sp. (This figure also shows a well-defined worm burrow.)

(All the figures are after Brongniart.)


1


2a
2b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2


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